Practice makes perfect

This year marks the 25th anniversary of shuttle's free-flight tests

By Lisa Tidwell

Like a child who must learn to walk before running, the space shuttle had to prove it could safely land before it could become NASA's main mode of transportation into space. The shuttle's landing abilities were proven in the Approach and Landing Test (ALT) program, using the orbiter test vehicle called *Enterprise*.

This year marks the 25th anniversary of the successful ALT program. The *Enterprise* began its journey at Rockwell International's Space Division in Palmdale, Calif., where it was assembled. In January 1977, the *Enterprise* traveled 36 miles over land from Palmdale to the place of its first flight – NASA's Dryden Flight Research Facility at Edwards Air Force Base.

While at Dryden, eight captive flight tests, three of them crewed, took place with the orbiter mounted atop the Shuttle Carrier Aircraft (SCA). The captive tests verified the aerodynamics and handling of the orbiter/747 combination and the orbiter systems. After these successful captive flights, the *Enterprise* was ready to fly solo.

On August 12, 1977, the NASA Space Shuttle *Enterprise* made history with its first free flight when it was released from atop the SCA at an altitude of 24,000 feet and guided to a successful landing on Runway 17 at Edwards. The shuttle spent five minutes and 22 seconds gliding down to Earth.

Astronauts Fred W. Haise and C. Gordon Fullerton were in control of the *Enterprise* during the historic first free flight.

"Just about everything associated with the ALT program was new and untried," Fullerton said recently. "In addition to the orbiter itself, the simulator, the Shuttle Training Aircraft, the Shuttle Carrier Aircraft, the manufacturing and checkout facilities at Palmdale were all being used for the first time during the preparation for the ALT flights."

During the subsequent four free flights, the astronaut flight crew alternated between Haise and Fullerton to Joe Engle and Richard Truly. The crews continued to release the shuttle from its perch atop the SCA to simulate free-flight landing conditions of a shuttle returning from orbit. These five free-flight tests allowed the pilots and engineers to learn how the shuttle handled during low-speed flight and simulated how it would land at the end of an orbital mission. The final free flight test, which took place Oct. 26, 1977, proved the space shuttle could successfully land on a concrete runway. After the ALT program, the Space Shuttle *Enterprise* was ferried around the world for air shows and made an appearance at the 1984 World's Fair in New Orleans, La. After a few months visiting NASA Centers, *Enterprise* became the property of the Smithsonian Institution in 1985. It was moved to Washington, D.C., where it still remains.

Since the early days of the shuttle program, nearly 700 passengers have been carried into orbit aboard the five shuttles: *Columbia*, *Challenger*, *Discovery, Atlantis* and *Endeavour*. *Discovery* is the most flown shuttle with 30 flights to its credit. ❖

Astronauts Fred W. Haise, Jr., left, and C. Gordon Fullerton are pictured in the cockpit of the *Enterprise* prior to the fifth and final free flight.

QUICK FACTS

The Approach and Landing Test Program

- The program consisted of 13 flights in all – five captive, three captive-active and five free flights – all of which occurred during 1977.
- The first free flight occurred on August 12, 1977. *Enterprise* was released from atop the Shuttle Carrier Aircraft at an altitude of 24,000 feet and spent five minutes and 22 seconds gliding down to Earth.
- Astronauts Fred W. Haise and C. Gordon Fullerton were in control of the *Enterprise* during the historic first free flight.
- Haise, who had also been the lunar module pilot for Apollo 13, resigned from NASA in 1979 and retired as president of Northrop Grumman Technical Services in 1996. Fullerton was the pilot of STS-3, commander of STS-57F and currently is a research pilot at NASA's Dryden Flight Research Center at Edwards.
- *Enterprise*, the space shuttle flight test prototype, was originally to be named "Constitution" in honor of the U.S. Constitution's bicentennial. However, viewers of the popular television show "Star Trek" started a write-in campaign urging the White House to name the first shuttle *Enterprise* after the show's "starship."

News from White Sands

By Cheerie R. Patneaude

A walk on the wild side: *White Sands Testing Facility is naturally interesting*

Not many NASA employees can say they come across rare night-blooming flowers, white pelicans or mating roadrunners as part of their jobs. However, that's all in a day's work for Amanda Skarsgard and Harold Harrison, who work as environmental scientists at JSC's White Sands Test Facility (WSTF) near Las Cruces, N.M.

The site has not been open to the public since its completion in 1964 because of the hazardous nature of the rocket engine and materials testing conducted there. Hunting, hiking and other recreational activities are prohibited on WSTF grounds, which means that the site's wildlife and vegetation have been protected for the past 38 years.

The undisturbed wildlife provides plenty of work for the two scientists. Skarsgard and Harrison have cataloged, observed and located a fascinating variety of artifacts, snakes, rare plants and birds on the site.

One night only: Night-blooming Cereus

WSTF is alive with 130 species of cataloged plants. Of these, Skarsgard estimates that 21 species are rare plants, with "rare" defined as threatened, endangered or species of concern. One of those rare plants is the Night-blooming Cereus, a cactus that grows within the branches of shrubs. It takes advantage of the reduced temperature and sunlight provided by the "nurse plant." Sixty-nine of these plants have been located on WSTF grounds.

"The individual flowers bloom for one night only," said Skarsgard, which is where the Night-blooming Cereus gets its name. "Its other name is *reina de la noche* or Queen of the Night," she said.

The plant is notable in other ways as well. Skarsgard cited the flower's extraordinary size and scent, as well as the plant's "cryptic" nature. "Very little is actually known about the Night-blooming Cereus behavior," she said.

Uncertainty about how the Cereus is pollinated is one reason for the decline of the plant's natural populations. Another reason is the collection and sale of the plants by individuals. Also, as the plant grows partially hidden within other plants, a Cereus may be uprooted with its nurse plant before it is even noticed.

Past and present

The WSTF grounds have a rich history: "We have 93 prehistoric archeology sites within the WSTF boundaries, including Love Ranch," Skarsgard said.

J. D. Love was a medical doctor and cattle rancher whose ranch was taken over during World War II for the U. S. Government to compile what is now the White Sands Missile Range. Today, the test facility's acreage backs up to the edge of the missile range, forming 28 square miles of refuge for New Mexico flora and fauna.

"The Test Facility and Missile Range are full of unique wildlife diversity," said Doug Burkett, Wildlife Biologist for the Missile Range. Desert bighorn sheep used to flourish in the area, but the population was devastated by parasitic infections several years ago. Now, "the New Mexico Department of Game and Fish is reestablishing the desert bighorn sheep in this area," Burkett said.

"A total of 176 bird species have been observed at the test facility, with many of them being sighted at Love Ranch,"" Harrison said.

He listed the following birds as rare sightings: Brown thrasher, a yellow-throated warbler, white pelicans, snipes and a vermilion flycatcher. He has also spotted white-throated swifts at WSTF's overflow lagoons – birds that Harrison said "were surely studied by the engineers and designers for the Stealth airplane."

Another of Harrison's favorite wildlife anecdotes involves what at first looked like "a fluttering pile of feathers in the roadway." He soon realized it to be "two mating roadrunners, the male with a lizard in his mouth. Afterwards, he gave the lizard to his companion."

Legacy of responsibility

Mark Leifeste, Honeywell Program Manager for the test facility, said that WSTF has "an obligation to maintain our facility and the surroundings that interface with our facility in a responsible fashion."

Joseph Fries, NASA Manager of the test facility, agreed. "I believe that we are good stewards of the environment, and that we have a moral obligation to take care of the land and its inhabitants," he said. "Many people have different opinions about taking care of the environment. I feel there should be a balance, rather than a strict policy, in creating regulation."

Fries said WSTF has a proactive plan it has worked out with the State of New Mexico and the U. S. Environmental Protection Agency. "We have accomplished and agreed upon a plan that will work in undoing the past sins of the test facility," he said. "I do want our grandkids to be able to enjoy the outdoors the same way my generation has."

Fries said that protecting and watching over the environment at the test facility is part of NASA's mission: To improve life here, to extend life to there, and to find life beyond. ❖

NASA WSTF 0702-1751

Harold 'Coach' Harrison and Amanda Skarsgard are environmental scientists at White Sands Test Facility. Skarsgard and Harrison have cataloged, observed and located a fascinating variety of artifacts, snakes, rare plants and birds on the site.

Flower (Night-blooming Cereus)-NASA WSTF 0596-1335
Snake (Black Neck Garter Snake)- NASA WSTF 0801-1855

Teamwork pays off

By Kylie Moritz

No one at JSC has ever won NASA's prestigious **Software of the Year Award** since its inception in 1994. That is, until now.

The hard work of an engineering team, led by Gerald "Jay" LeBeau, in the Aeroscience and Flight Mechanics Division has earned it this year's prize of $50,100.

"This is great recognition – not only for our team, but for the division, engineering directorate and JSC as well," LeBeau said.

LeBeau and his team earned the award for their Direct Simulation Monte-Carlo (DSMC) Analysis Code (DAC) software, which simulates rarefied gas dynamic environments. Because tests to gain knowledge on the interactions of spacecraft and rarified environments are difficult and expensive to perform, the software has the potential of saving many millions of dollars.

It has been used to support many JSC programs, including the International Space Station, X-38, space shuttle servicing missions to the Hubble Space Telescope and the Shuttle-Mir program. Other NASA Centers have used it to analyze the Mars Pathfinder, Stardust, Genesis, X-33, X-37, Mars Global Surveyor and Mars Odyssey vehicles. The revolutionary software is even being used by other government agencies, including the Department of Defense, to provide critical design information for missile defense concepts.

The team members who worked together to create the software include JSC's LeBeau, Forrest Lumpkin, Katie Jacikas and Phil Stuart, and Langley Research Center's Richard Wilmoth and Christopher Glass.

LeBeau first came to JSC in 1987 through the Cooperative Education Program program. In the early 1990s, LeBeau was working with simulation software to analyze how shuttle jet thruster firings might affect a future space station during rendezvous and docking operations. It was then that he started writing a completely new software package from scratch with better analysis capabilities than the current software, originally developed at Langley Research Center.

The team members at JSC, all stationed in the same room in Building 16, have worked together to improve the software. As part of NASA's Professional Development Program (PDP), Lumpkin taught a class at Rice University on the theory of the DSMC method. LeBeau and Stuart attended that class, which provided the fundamentals for LeBeau to create the new software.

"It may have even helped that I was a little inexperienced with the subject because I wasn't afraid to try things that hadn't been considered before," LeBeau said.

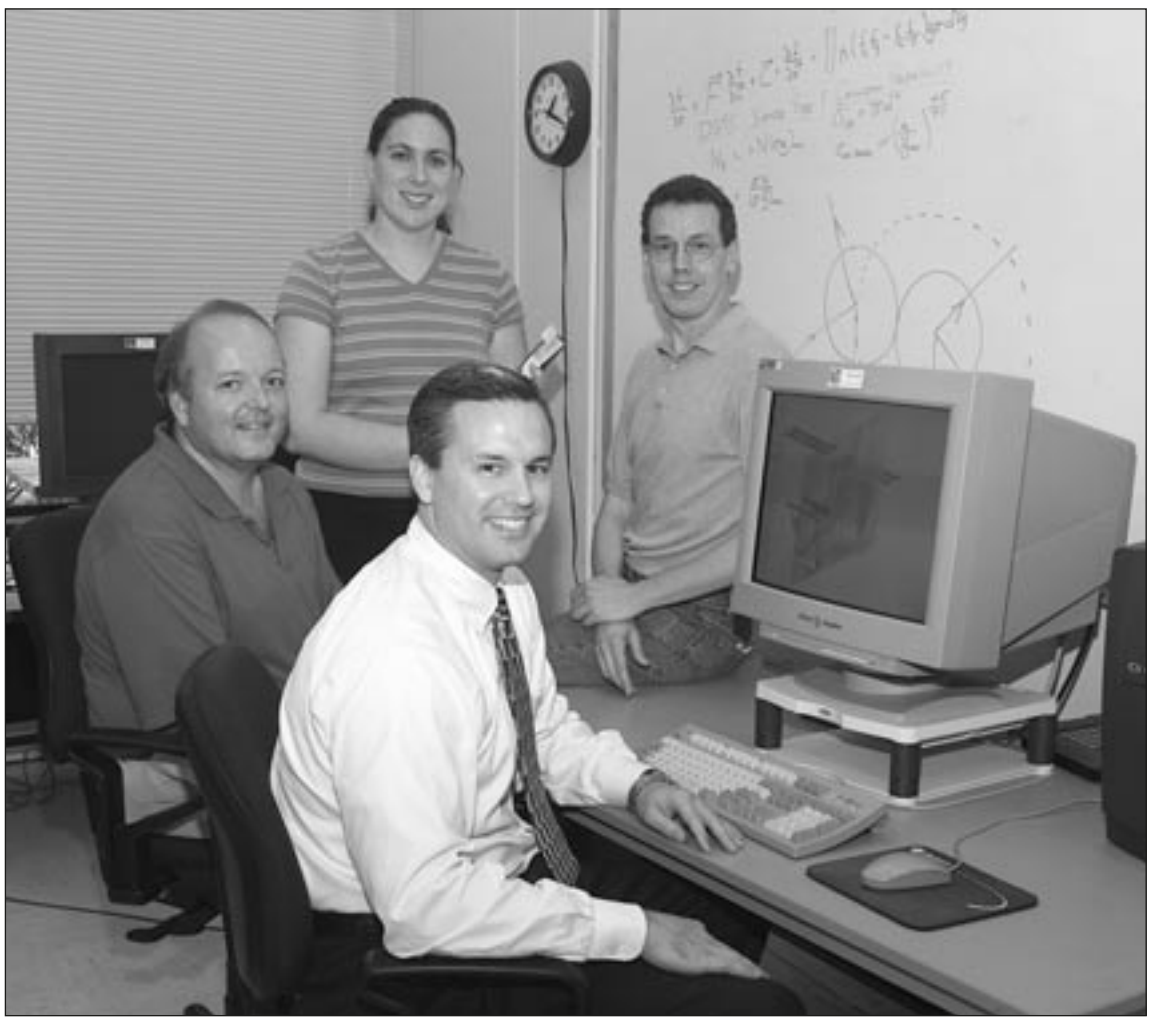
In 1995, during a one-year rotation through the PDP, LeBeau began writing the new software with help from the team members at Langley. Wilmoth, who had much more familiarity in the field, served as a mentor to LeBeau, providing expert insight to the project. Glass helped by verifying and validating the upgraded software.

In 2000, Jacikas brought in fresh ideas when she began working on the project at JSC as a co-op student. With LeBeau's guidance, she helped implement new capabilities for the software and continues to work with the team as a permanent employee. Stuart has worked with the team to integrate some of the software's post-processing capabilities.

The JSC team was co-awarded the Software of the Year Award with a team at Ames Research Center by NASA's Inventions and Contributions Board and Chief Information Officer.

"It is definitely an honor to be considered in the same league as the team members at Ames. I have a lot of respect for them and their work," LeBeau said. The software developed at Ames, Cart3D, is an aerodynamic simulation tool that provides designers and engineers with an automated, highly accurate computer-simulation suite that streamlines the conceptual and preliminary analysis of both new and existing aerospace vehicles.

More information about the winners may be found online at: http://icb.nasa.gov/swoy2002/.



NASA JSC 2002e36405 Photo by David DeHoyos

A NASA engineering team, led by Johnson Space Center's Jay LeBeau, was recently selected for the NASA Software of the Year Award. Pictured clockwise are the JSC team members who worked together to create the software: Katie Jacikas, Phil Stuart, Jay LeBeau and Forrest Lumpkin. Not pictured are Richard Wilmoth and Christopher Glass, two team members from Langley Research Center.

SPACE CENTER Roundup

The *Roundup* is an official publication of the National Aeronautics and Space Administration, Johnson Space Center, Houston, Texas, and is published by the Public Affairs Office for all space center employees. The *Roundup* office is in Bldg. 2, Rm.166A. The mail code is AP121. The main telephone number is x39978, and the fax is x32000. Visit our Web site at: www.jsc.nasa.gov/roundup/weekly/ Electronic mail messages may be directed to:

Managing Editor . . . . . .Melissa Davis. . . . . melissa.davis1@jsc.nasa.gov

PRSRT STD
U.S. POSTAGE
PAID
WEBSTER, TX
Permit No. G27